PATENT SPECIFICATION 1,109,135

NO DRAWINGS.

1,109,135

Date of Application and filing Complete Specification: 13 July, 1965. No. 29655/65.

Application made in Netherlands (No. 6,408,081) on 16 July, 1964.

Complete Specification Published: 10 April, 1968.

Index at Acceptance:—H1 D(5P2, 9D, 9Y, 11X, 11Y, 12B1, 12B2, 12B3, 12B4, 12B7, 12B13Y, 12B47Y, 12C, 35).

Int. Cl.:—H 01 j 61/20.

COMPLETE SPECIFICATION

Improvements in and relating to Super High Pressure Mercury Vapour Discharge Lamps.

We, PHILIPS ELECTRONIC AND ASSOCIATED INDUSTRIES LIMITED, of Abacus House, 33 Gutter Lane, London, E.C.2., a British Company, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention relates to a super high-pressure mercury vapour discharge lamp of the type which comprises a gas atmosphere in a discharge space, which contains at least a rare gas and mercury vapour and in which a super high-pressure discharge is produced, whilst at the prescribed voltages and currents the pressure exceeds 15 atmospheres. This super high-pressure discharge is constricted in operation and stabilised by the wall.

Known discharge lamps of the kind set forth exhibit by the high pressure a spectrum of the emitted radiation of great width, which means that radiation is found with very many wavelengths in the visible region. The luminous efficiency of these lamps, i.e. the number of lumens emitted per Watt, is very high, usually higher than 50 lumens per Watt.

When such lamps are used for reproducing colours, for example, when used as a projection lamp for reproducing colour films or colour slides, some wavelength regions exhibit an insufficient quantity of radiation in spite of the wide spectrum of the emission; in other wavelength regions excessive radiation is emitted. The invention has for its object to improve the colour reproduction by producing radiation in those wavelength regions in which the emission is insufficient.

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The invention provides a super high-pressure mercury vapour discharge lamp of the type hereinbefore defined, wherein that the discharge space furtheremore contains at least one of the elements tin, germanium, arsenic, antimony and manganese and a quantity of iodine expressed in chemical equivalents which is at least equal to half the total quantity of said elements expressed in chemical equivalents and at the most equal to the sum expressed in chemical equivalents of the quantity of mercury and the total quantity of said elements, and wherein the discharge space contains from 0.03 to 0.15 mg. of mercury per cubic millimetre.

By the addition of the aforesaid elements to the gas atmosphere a spectral distribution of the emitted light may be obtained, which fulfils the requirements of a satisfactory colour reproduction considerably better than that of a lamp having only mercury vapour and a rare gas. It is found that given peaks of the mercury spectrum are suppressed, whereas in spectral regions having insufficient radiation additional radiation is emitted from the spectrum of the additional elements.

The quantity of iodine expressed in chemical equivalents in the discharge space must be at least equal to half the total quantity expressed in chemical equivalents of the elements tin, germanium, arsenic, antimony and maganese. With a smaller quantity of iodine it is possible that not all the additional elements change over to the vapour phase, so that they cannot take part in the discharge. The quantity of iodine expressed in chemical equivalents is at

the most equal to the sum expressed in chemical equivalents of the quantity of mercury and the total quantity of these elements. If a greater quantity of iodine is used, difficulties may arise in the ignition of the lamp. The discharge space preferably does not contain more iodine than the quantity which is chemically equivalent to the total quantity of the elements tin, germanium, arsenic, antimony and manganese.

The ratio between the total quantity of the elements tin, germanium, arsenic, antimony and manganese and the quantity of mercury in the discharge space is preferably between 1:100 and 1:2, wherein these quantities are expressed in chemical equivalents. Then a very satisfactory compromise is obtained between a high light output and a satisfactory colour reproduction.

A further improvement may be obtained by using in addition to iodine, mercury and the above-mentioned elements in the discharge space, at least one of the elements thallium, indium and sodium, so that the intensity ratios between the various spectral regions can be corrected in favour of an improvement in the colour reproduction. By using thallium, indium and sodium in the discharge space the intensity of the green, blue and yellow mercury lines at wavelengths of 546.1, 435.8, 577.0 and 579.1 mμ respectively are compensated by absorptions in spectral regions in the proximity of said lines. To this end the ratio between the total quantity of the elements thallium, indium and sodium and the total quantity of the elements tin, germanium, arsenic, antimony and manganese must lie between 1:4 and 10:1, wherein these quantities are expressed in chemical equivalents.

In order to further improve the colour reproduction of lamps according to the present invention the discharge space may furthermore contain zinc and/or cadmium. These elements emit red light in the discharge, which produces a warmer colour impression. The ratio between the total quantity of zinc and cadmium and the quantity of mercury is preferably between 1:4 and 1:1, wherein these quantities are expressed in chemical equivalents.

By varying the quantities of the various elements within the limits mentioned above, the colour reproduction of, for example, a high-intensity carbon arc or of a xenon discharge lamp can be very closely approached.

The super high-pressure mercury vapour discharge lamp according to the invention, like the lamps hitherto known, comprise a capillary tube, for example of quartz glass, in which two tungsten electrodes are provided at the ends. The capillary tube is preferably cooled by a flow of air or water.

For comparing the spectral distributions obtainable by the various gas fillings, discharge tubes were made having an inner diameter of less than 4 mms and an arc length of less than 20 mm. The ratio between the arc length and the inner diameter of the discharge space was chosen to be greater than 4:1. The power of the lamp was 1000 W with an idle current of 200 mA. It is known that such lamps are often driven in a pulsatory manner; during the measurements a pulse frequencyy of 72 c/s was chosen.

An experimental lamp, the emission of which approached the colour reproduction of a xenon arc lamp, had the following filling in the discharge space: 2.0 mgs. of Hg, + 1.2 mgs. of SnI_4 + 0.2 mgs. of TlI and 2.1 mgs. of Zn. The rare gas was here argon.

An experimental lamp, the colour reproduction of which approached that of the high-intensity carbon arc lamp, had the following filling in the discharge space: 3.0 mgs. of Hg, + 1.0 mg. of GeI_4 + 0.2 mg. of TlI + 0.7 mg. of Zn + 1.2 mgs. of Cd. The rare gas was also argon.

WHAT WE CLAIM IS:—

1. A super high-pressure mercury vapour discharge lamp of the type hereinbefore defined, wherein the discharge space furthermore contains at least one of the elements tin, germanium, arsenic, antimony and manganese and a quantity of iodine expressed in chemical equivalents which is at least equal to half the total quantity of said elements expressed in chemical equivalents and at the most equal to the sum expressed in chemical equivalents of the quantity of mercury and the total quantity of said elements, and the discharge space contains from 0.03 to 0.15 mg. of mercury per cubic millimetre.

2. A super high-pressure mercury vapour discharge lamp as claimed in Claim 1, wherein the quantity of iodine expressed in chemical equivalents in the discharge space is equal to the total quantity expressed in chemical equivalents of the elements tin, germanium, arsenic, antimony and manganese.

3. A super high-pressure mercury vapour discharge lamp as claimed in Claim 1 or Claim 2, wherein the discharge space contains at least one of the elements thallium, indium and sodium.

4. A super high-pressure mercury vapour discharge lamp as claimed in any preceding Claim, wherein the discharge space contains zinc and/or cadmium.

5. A super high-pressure mercury vapour discharge lamp as claimed in any preceding Claim, wherein the ratio between the total quantity of the elements tin, germanium, arsenic, antimony and manganese and the

quantity of mercury in the discharge space lies between 1:100 and 1:2, wherein the quantities are expressed in chemical equivalents.

6. A super high-pressure mercury vapour discharge lamp as claimed in Claim 3, containing at least thallium, wherein the ratio between the total quantity of thallium, indium and sodium, and the total quantity of the elements tin, germanium, arsenic, antimony and manganese is within the range from 1:4 to 10:1, wherein these quantities are expressed in chemical equivalents.

7. A super high-pressure mercury vapour discharge lamp as claimed in Claim 1 and substantially as herein described.

T. D. THREADGOLD,
Chartered Patent Agent,
Century House,
Shaftesbury Avenue,
London, W.C.2.,
Agent for the Applicants.

Printed for Her Majesty's Stationery Office by Burgess & Son (Abingdon), Ltd.—1968.
Published at The Patent Office, 25 Southampton Buildings, London, W.C.2,
from which copies may be obtained.